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A NEW SPECIES OF HUMMINGBIRD FROM PERU

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In June 1975, during a brief avifaunal survey of the previously unexplored Cordillera del Condor in northern Peru, we encountered a common, small, midnight-blue hummingbird occupying the brushy slopes bordering moist cloud forest. The single specimen we obtained, a sub-adult male, matched no known species and even its generic affinities were uncertain. Returning to the site in July 1976, we collected a small series of this spectacular hummingbird, including several females. The species represents a distinctive new member of the genus *Heliangelus* (the sunangels), as described below (see frontispiece).

Heliangelus regalis sp. nov.

ROYAL SUNANGEL

HOLOTYPE.—American Museum of Natural History no. 823987; adult male from the Cordillera del Condor, above San José de Lourdes, dept. Cajamarca, Peru 5° 02′ S, 78° 51′ W, elevation 1950 m; collected 14 July 1976 by J. W. Fitzpatrick.

DIAGNOSIS.—A small-bodied, straight-billed, sexually dimorphic trochiline with an elongated, deeply forked tail. Entire plumage of adult males deep blue-black, showing no trace of green iridescence and no gorget. Male most similar to *Eriocnemis nigrivestis*, but lacking leg puffs, nasal operculum mostly exposed (not covered by compressed feathers as in *Eriocnemis*), tail much longer and deeply forked, and lacking bright iridescence on gorget, rump, and undertail coverts. Female closest to *Heliangelus mavors*, but distinguished from all female *Heliangelus* by elongated and deeply forked, entirely iridescent, metallic blue tail, equally bright on both surfaces; combined with buffy underparts interrupted by a pale pectoral band.

DISTRIBUTION.—Known only from the vicinity of the type locality: in the dept. Cajamarca, Peru, at elevations from 1950 to 2200 m on the southern extremity of the Cordillera del Condor, east of the Rio Chinchipe valley; range probably extends northward on this mountain ridge along the border of Peru and Ecuador.

DESCRIPTION OF HOLOTYPE.—Entire body plumage, including upper and undertail coverts, all wing coverts, and innermost secondaries, deep violet-blue, slightly bluer and much darker than Spectrum Violet (capitalized colors are from Smithe 1975); body

plumage slightly iridescent throughout, appearing deep purple to nearly black in poor light; brighter iridescence of forecrown approaches Cyanine Blue. Outer secondaries and all primaries blackish with faint violet iridescence; a few tiny feathers along the alular region tipped Tawny; thighs and proximal half of tarsus feathered dark blue as body; small, semi-concealed patch of downy white feathers on crissum. Rectrices entirely dark Spectrum Violet, slightly bluer basally and on outer webs, and with bright, metallic blue iridescence on both dorsal and ventral surfaces. Tail long and deeply forked, outermost rectrices 1.9 times longer than innermost; distal half of outer 2 pairs of rectrices bowed slightly inward. Culmen feathered nearly to anterior end of nasal operculum, these feathers entirely covering the operculum over about ⅓ of its length. Soft parts colors in life: bill and feet black, irides dark brown.

MEASUREMENTS (mm) OF HOLOTYPE.—Wing chord 53.2, outermost rectrix 55.0, innermost rectrix 29.5, culmen (from anterior end of operculum) 13.8; weight, 3.7 g.

SPECIMENS EXAMINED.—Ten males, 6 females from the type locality (AMNH 2 ♂, 1 ♀; LSUMZ 4 ♂, 3 ♀; MCZ 3 ♂, 1 ♀; FMNH 1 ♂, 1 ♀).

REMARKS

Description of allotypes.—Six females were collected from the type locality. The crown, mantle, wing coverts, rump and uppertail coverts of all females are dark, oily green, with iridescence varying between specimens from deep blue to bronzy. The upper tail coverts of a few specimens are bluer than the back and rump. Remiges are dusky, showing little iridescence. A narrow superciliary, an indistinct malar streak, and the entire underparts are rich Cinnamon, varying in intensity between specimens but always darkest on the lower throat and on the belly. Underparts are mottled to varying degrees with dark, bronzy-green discs, which are small and arranged along indistinct longitudinal rows on the chin and throat (see frontispiece and Fig. 1). A broad, pale buffy breast band separates the smaller throat spots from larger and more numerous discs on the breast and flanks. In a few specimens the posterior border of the breast band is entirely defined by a broad row of these discs. The belly is free of dark spots in all specimens. The downy crissum is white as in males, and the undertail coverts are dusky, edged Cinnamon. All but the central pair of rectrices are deep, metallic blue, iridescent on both surfaces as in males. The central rectrices of 4 of the 6 females show a greenish sheen near the base. The outermost pair in 5 specimens shows a barely discernible whitish tip, especially on the outer web. The tails of females are shorter and less deeply forked than in males (see Table 1). One specimen (FMNH no. 299434) had poorly developed ovaries. Its buffy throat is entirely mottled with pale gray, and lacks the distinct, bronzy-green spots present on the other specimens. Its breast band is paler than in the remaining females, and the dark discs on breast and flanks are poorly defined. These features probably characterize young females. Soft part colors in life resemble those of the holotype.

TABLE 1

MEASUREMENTS (MM) OF *HELIANGELUS REGALIS* FROM THE TYPE LOCALITY

	Adult males (N = 5)			Subadult males (N = 5)			Females (N = 6)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Wing chord	53.4	0.9	52.2–54.5	52.8	1.3	51.0–54.5	50.7	0.6	50.0–51.6
Exp. culmen	13.7	0.3	13.4–14.2	13.4	0.4	13.0–14.0	14.3	0.9	13.2–15.8
Outer rectrix	52.4	2.2	50.5–55.0	47.3	1.7	46.0–50.0	40.3	1.2	39.5–42.0
Central rectrix	27.9	1.2	26.5–29.5	27.9	1.0	26.5–29.0	27.0	1.5	26.0–28.0
Fork depth[1]	1.9		1.8– 1.9	1.7		1.6– 1.8	1.5		1.4– 1.6

[1] Fork depth = outer rectrix length/central rectrix length.

Variation among males.—The 10 males, all collected between 20 June and 23 July, fall into 2 plumage categories. Five specimens, including the holotype, are uniformly iridescent midnight blue over the entire body. Two of these specimens show a thin, concealed band of pale buffy marks on the breast, probably homologous to the females' breast bands. Otherwise little color variation is evident among these presumed adults. The remaining 5 specimens, apparently subadults, show varying amounts of iridescent dark green on the crown, mantle, rump and flanks, along with distinct Tawny tips on blue or blue-green feathers of the lower breast, posterior flanks, and belly. The amount of this buffy scaling varies directly with the extent of green on the upperparts. One specimen (MCZ no. 330694) is entirely green above, and shows a faint breast band of buffy scaling, suggesting the female pattern. In this specimen, typical midnight blue feathers appear only along a medial stripe down the throat and irregularly across the lower breast. This and 3 other subadult males show some active molt. As judged from these subadults, the emergence of dark blue feathers apparently begins on the throat, followed by emergence on the crown, mantle and lower breast. The auriculars, nape, lower back and belly retain subadult coloration the longest. The outermost rectrices of these subadult males are significantly shorter than those of the adults (means of 47.3 vs 52.4 mm), although they still are longer than those of females (see Table 1). Wing and bill lengths are similar between the 2 age classes.

Systematic relationships.—Although *regalis* is a peculiar and distinctive species, its inclusion in the genus *Heliangelus* is supported on a number of counts. Among sexually dimorphic, straight-billed hummingbirds the unusual combination of a speckled throat and a dark-bordered pale breast band in the female is found only within *Heliangelus* (see Fig. 1). Indeed, the entire

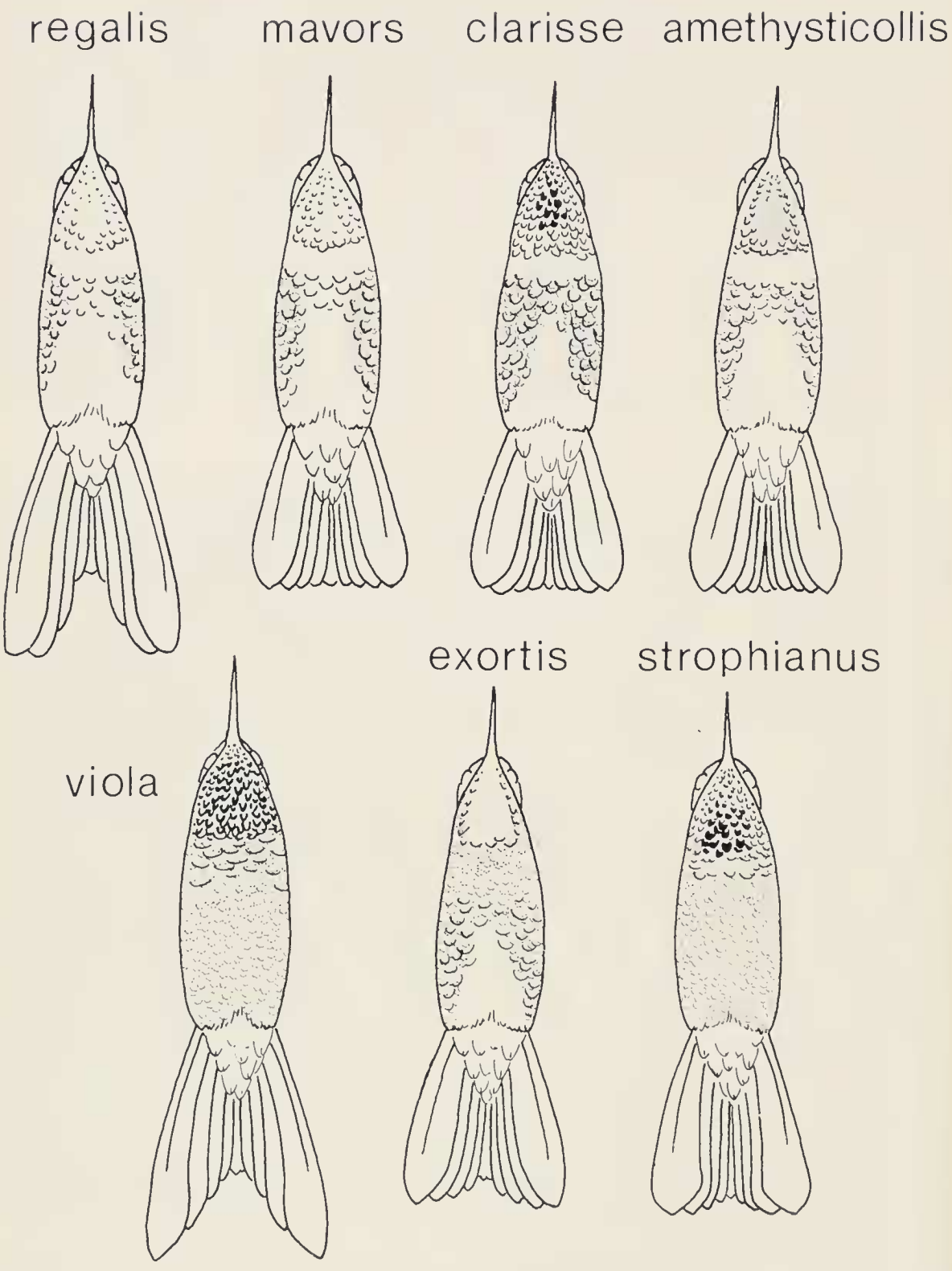

FIG. 1. Ventral patterns and tail forms of *Heliangelus* females, including *H. regalis*. *H. micrastur* female resembles *exortis*, and *H. spencei* resembles *amethysticollis*. Note similarity between *regalis* and *mavors*.

underparts of female *regalis* closely resemble those of female *H. mavors* (Orange-throated Sunangel), differing only by a paler breast band and slightly darker, less numerous blue-green spots and discs. As shown in Fig. 2, the relative bill length, nostril feathering, and well delineated nasal operculum of *regalis* all fall within the range of variation among *Heliangelus* species. Sabre-shaped outer rectrices in both males and females, faintly tipped grayish or white in the latter, characterize all species of *Heliangelus*. Elongation of the outer rectrices into a deeply forked tail, while reaching an extreme in *regalis*, is found in *H. exortis*, *micrastur* and especially *viola* (Tourmaline, Little and Purple-throated sunangels, respectively; see Fig. 1). In all species of *Heliangelus*, including *regalis*, the proximal half of the tarsus is sparsely feathered. Tarsal plumes, which characterize the adjacent genus *Eriocnemis* (the pufflegs), are entirely lacking. This distinction is important in that the male *regalis* superficially resembles several species of *Eriocnemis* more than any species of *Heliangelus*. All species of *Eriocnemis* also possess iridescent chins and undertail coverts, as well as compressed nostril feathers that entirely conceal the operculum. These features are lacking in *regalis* and its congeners.

The affinities of *regalis* within *Heliangelus* are not clear. Unlike the monochromatic male *regalis*, males of all previously known *Heliangelus* have well defined, brilliantly iridescent violet or orange gorgets that contrast with a deep green head and body plumage. In 4 of these 7 species (*mavors*, *clarisse*, *amethysticollis*, *strophianus* following Peters [1945]: Orange-throated, Longuemare's, Amethyst-throated and Gorgeted sunangels, respectively) the gorget is bordered below by a white pectoral band, appearing as a white or buffy band in the females (see Fig. 1). The presence of this breast band in female *regalis* suggests that the new form is closest to this species group. The extreme similarity between females of *regalis* and *mavors* was mentioned above. However, male *mavors* shows a well developed, fiery-orange gorget and forecrown. Its body plumage is the palest green of any in the genus, and its broad, squared tail is bronzy-green and pale-tipped. Thus, if *regalis* is indeed closest to this species as suggested by the appearance of the female, it has undergone a dramatic differentiation in which the male converged upon several more distant relatives. The elongated, narrow, metallic blue tail in both sexes of *regalis*, equally iridescent on both surfaces, is suggested only in *H. strophianus* (sexes similar) and *viola* (very large, dark green female lacks a breast band). Confirmation of *regalis*' exact position in *Heliangelus* may be possible using anatomical comparisons, but the necessary specimens are presently unavailable.

Behavior.—Both male and female *H. regalis* showed a distinct preference for nectar from 1 species of flowering melastome (*Brachyotum quinquenerve*)

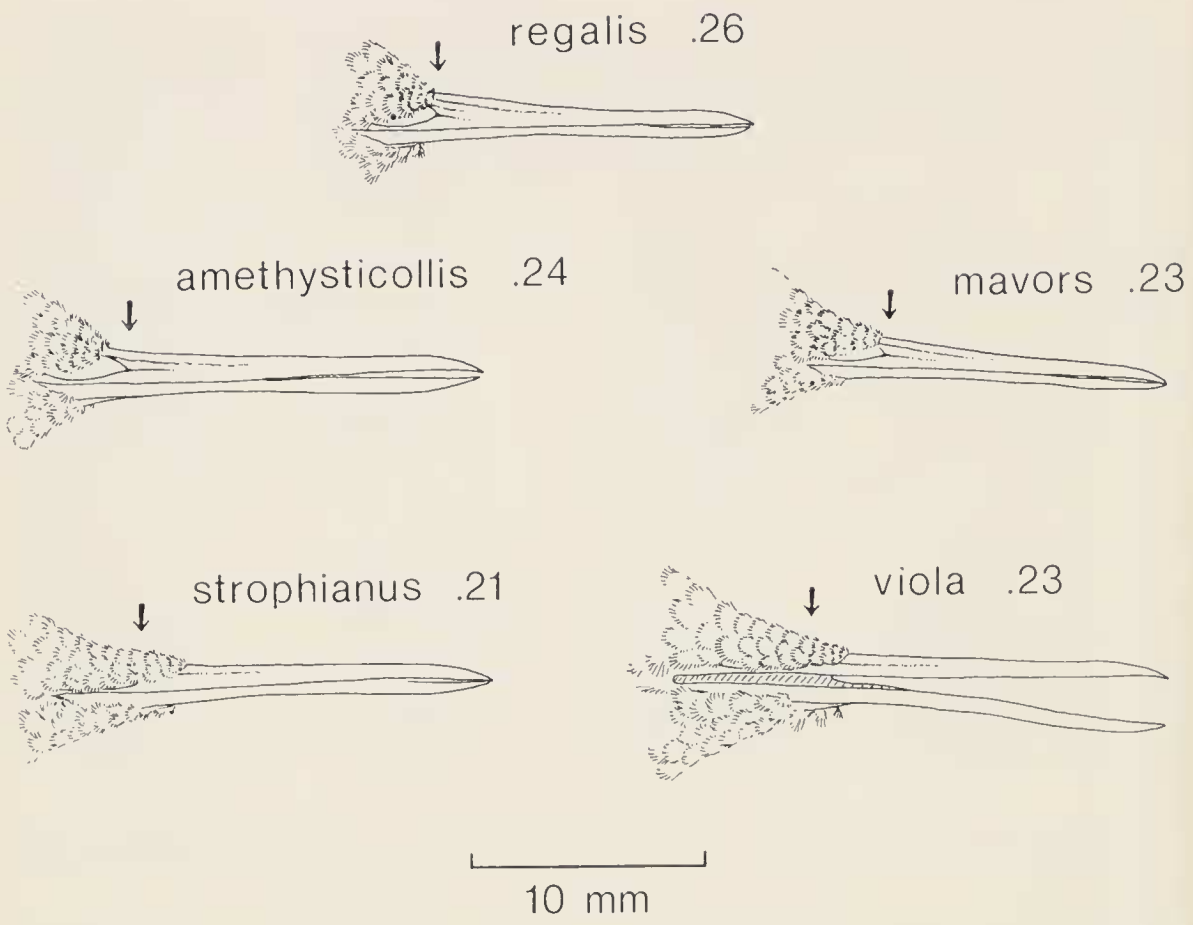

FIG. 2. Bill shape, nostril feathering, and nasal operculum characteristics in *regalis* and some representative *Heliangelus*. Small arrows show the position of the anterior end of operculum in relation to the nostril feathering. Ratio of exposed culmen to wing length is shown for each species illustrated.

during June and July. *Brachyotum*, a low shrub, has abundant flowers arranged serially along multiple stems. Its deep purple petals form a tubular corolla that hangs vertically (see frontispiece), forcing the foraging hummingbird to hover directly below and point its bill straight upward to retrieve the nectar. This plant, which forms dense stands, is an abundant component of the brushy habitat of *H. regalis*, and the genus is known to be an important food source for hummingbirds in northern Peru (Wurdack 1965). Although the most common single flowering species in June and July, *Brachyotum* was not the only flower available at this site. At least 2 other melastomes (including *Tibouschina ochypetala*) were in full flower, along with 2 common, shrubby Compositae and several other unidentified plants. Nevertheless, nearly all of *H. regalis*' flower visits we observed were at *Brachyotum*. Individuals frequently could be seen travelling systematically from flower to flower within clumps of *Brachyotum*, usually at heights of 0.5 to 2 m within dense foliage.

At an estimated 25% of the flower visits we observed (N = ca. 200), *H. regalis* fed on nectar by perching on the stem below the flower, rather than hovering. Nectar was invariably taken through the open end of the corolla. All observers present agreed that its habit of perching to feed seemed more regular than in other hummingbirds in our experience. Whether or not this habit results from the heavy use of a short, vertically hanging inflorescence remains unknown. *H. regalis* also frequently forages for small insects. Individuals sally outward or upward several m from an exposed perch to snatch aerial prey, and usually return to the same perch.

H. regalis was highly territorial during the season we were present. When not foraging, individual males could be found sitting quietly on exposed perches near or over the top of the shrubby vegetation, and single males regularly returned to favored perches. Male-male chases were common. Chases were accompanied by a series of high-pitched *tick* notes, presumably given by the aggressor. Often these vocalizations merged into sweeter notes, whistled with an upward slur. Females occasionally uttered these same notes during long flights away from a flower clump after foraging. We estimated the territory sizes of males to be about 40–50 m in diameter, and all such territories contained good stands of *Brachyotum* in full bloom.

Two kinds of stereotyped display behavior were observed. (1) Especially just after dawn, a male was occasionally seen perched on an exposed twig up to about 6 m high, uttering a series of high-pitched, warbled, "tinkling" notes lasting 3 sec or more. This series ended with a long flight out from the perch, during which the bird traced a circle of varying diameter up to about 10 m before returning to the perch. This circular flight was then repeated on the opposite side of the perch, resulting in a "figure 8" flight pattern with the perch at the center. While flying the bird uttered the single *tick* notes described above, but upon landing at the perch he resumed the "tinkling" series of sweet whistles. (2) A male-female display was observed once by Gary R. Graves, who has kindly provided his description for our use. The following account is quoted from his notes:

> Initially a pair [of *regalis*] was foraging around the walls of [a vine-covered sinkhole] and in the surrounding shrubs along the rim. Both male and female were observed perching on a rootlet, making frequent sallies to capture tiny flying insects . . . . Three times a male was seen to displace a female from a perch. An adult male displaced an immature male once . . . . After an unseen but heard confrontation in nearby thick bushes, 2 males and 2 females appeared at the 'favorite' perch halfway down the sink wall. One pair remained only about 15 sec and then flew quickly away with a series of rapid chipping notes. The remaining pair sat quietly for another 20 or 30 sec and then flew to a

> densely branched, but thinly leaved shrub. The female remained on one perch, silently, while the male . . . changing positions above the female every 10 to 15 sec, fanned his tail, held his bill vertically, and raised his wings. While in this posture, with wings and tail flicking and vibrating rapidly, the male delivered a high-pitched, jumbled series of notes 2 to 3 sec long, repeated every 3 to 4 sec. This display lasted about 2 min and ended when the female flew off.

Upon alighting on a twig, *H. regalis* habitually holds its wings out-stretched, and occasionally quivers them slightly, before folding them. This motion is even more conspicuous and exaggerated in *H. amethysticollis*.

Breeding and molt.—As suggested by the display activities described above, *regalis* appeared to be actively breeding during our second visit, from 12 to 31 July 1976, coinciding with the onset of a relatively dry season. Males were far more visible than females during this period, suggesting that many females may have been incubating. No nests were located, but 4 of 5 adult-plumaged males, and 1 subadult specimen, showed swollen testes. Two of the 6 females showed enlarged follicles indicative of breeding condition. As mentioned above, light body molt is evident on 4 of the 5 subadult males. One adult male and at least 4 females also show body molt, but no wing or tail molt is present on any specimen.

Habitat and ecology.—The type locality of *Heliangelus regalis* is the same as that described and mapped in Fitzpatrick et al. (1977) for the Bar-winged Wood Wren (*Henicorhina leucoptera*). The Cordillera del Condor is a low, narrow mountain ridge that forms a border between Peru and southeastern Ecuador over most of its length. The ridge is separated from equivalent elevations on the main Andes to the west by about 40 km. At its southern extremity, entirely within Peru, the ridge reaches an elevation of about 2850 m, where it is capped by a dense but stunted cloud forest growing on a leached, desiccation-prone sandstone substrate. Our camps were placed at several elevations near the southernmost edge of this moist forest, along a mule trail leading eastward over the ridge from San José de Lourdes. To the south, the forest gives way abruptly to a mosaic of dense, brushy hillsides, grazed and frequently burned grassland, and black-water bogs in the shallow valleys between hills.

H. regalis appeared to be most numerous in the brushy slopes bordering the forest edge and along steep ravine banks, at elevations from 1950 m to 2200 m. In these sites the vegetation is characterized by abundant melastomes (at least 3 common species) and an undergrowth containing Ericaceae and large stands of bracken ferns. The brush is extremely dense up to 1 or 2 m in height, and reaches heights of 4 to 5 m along ravines and near the forest border. The hummingbird was occasionally sighted, and once mist-netted.

inside the forest in areas where sparse canopy permitted a proliferation of understory plants. The open bogs and burned pastures to the south of the forest edge appeared not to be visited by *Heliangelus regalis*. Other hummingbirds mist-netted or observed at this elevational zone were, in order of decreasing abundance: (1) interior forest: Speckled Hummingbird (*Adelomyia melanogenys*), Booted Racket-tail (*Ocreatus underwoodii*), Bronzy Inca (*Coeligena coeligena*), Long-tailed Sylph (*Aglaiocercus kingi*), Chestnut-breasted Coronet (*Boissonneaua matthewsii*), Whitetip (*Urosticte benjamini*) and Green-fronted Lancebill (*Doryfera ludoviciae*); (2) open brush and bogs: Green Violetear (*Colibri thalassinus*), Green-tailed Trainbearer (*Lesbia nuna*) and Sparkling Violetear (*Colibri coruscans*). In the dense brush at about 2000 m, *Heliangelus regalis* was outnumbered only by *Colibri thalassinus*.

Our highest camp was placed atop a vertical precipice overlooking the Rio Chinchipe valley to the west, at an elevation of 2450 m. This site, about 2 km NNE of the lower camps, is entirely forested up to the edge of the rock face. At this elevation, *Heliangelus regalis* appeared to be absent, while *H. amethysticollis* was the most common hummingbird along the forest border at the edge of the cliff. Thus the new species may be ecologically replaced at upper elevations by a congener, as is typical of many Andean bird species including other hummingbirds (Terborgh 1971, Terborgh and Weske 1975). In the forest, Collared Incas (*Coeligena torquata*) appeared to replace *C. coeligena* in a similar fashion between 2200 and 2450 m.

So far as is known, *Heliangelus regalis* is restricted to forest edge habitats at middle elevations of the isolated Cordillera del Condor. The existence of many endemic species and subspecies on this ridge amidst a somewhat depauperate bird fauna (Fitzpatrick et al. 1977) supports the hypothesis that the island-like configurations of Peru's many isolated mountain ridges have provided conditions of reduced competition within which relict populations could persist and differentiate. The new *Heliangelus* described here is only 1 such example. Exploration of these ridges continues to produce new forms with remarkable frequency (see O'Neill and Graves 1977).

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